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NUCLEAR-POWERED VESSELS IN THE UNITED STATES NAVY: AN ANALYSIS OF AUTHORIZATIONS, POLICIES AND PROBLEMS

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CHAPTER I

INTRODUCTION

Statement of the Research Question

There are strong indications that a major national defense problem which will continue to confront the United States is the matter of nuclear propulsion for the Navy. Almost from the day in 1947 when an engineering duty officer, Captain Hyman G. Rickover, began his campaign for nuclear propulsion in Navy ships, the road has been bumpy and many battles have been fought. There have certainly been milestones in the progress of the Navy's nuclear program, the most monumental of which probably occurred in 1954 when the words, "Underway . . . On Nuclea Power," were reported by Commander Eugene Wilkinson, Commanding Officer of the world's first nuclear propelled submarine, USS Nautilus.[1]

During the past eighteen years, since those words were uttered, the question of nuclear propulsion has filled literally thousands of pages of Congressional testimony, Department of Defense and Navy studies, books, magazine and newspaper articles. Most recently, on December 12, 1971,

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[1]Elton C. Fay, "Past--Present--Future: A Look at 15 Years of the Nuclear Navy," Navy, The Magazine of Sea Power (Feb., 1970), p. 14.

the Los Angeles Times carried an article about a "Billion Dollar Aircraft Carrier."[1]

The common fiber of most discussions relating to nuclear propulsion has been the apparently excessive investment differential between nuclear-powered vessels and their conventionally propelled counterparts. The words "apparently excessive" are utilized because there has been a running battle between the civilian systems analysts in the Department of Defense on one hand, and the Congress and Vice Admiral Rickover on the other, relative to the "cost effectiveness" of nuclear power. For example, the September 21, 1968, issue of the Armed Forces Journal reported as follows on the passage of the fiscal year 1969 (FY 1969) military procurement authorization bill:

> House Armed Services Committee Chairman L. Mendel Rivers . . . [pointed out that] 'This is the smallest number of new construction nuclear warships included in any defense authorization bill in the last 14 years. . . . This is what cost effectiveness has done to this country. . . . I urge the Department of Defense and the Navy to work out a satisfactory nuclear escort program. If they cannot, the Congress will have to continue to do it for them.[2]

Secretary of the Navy Paul R. Ignatius told the House Defense Appropriations Subcommittee on May 2, 1968, that "nuclear power is a highly desirable thing for the Navy, but it must be used selectively." He said that all new carriers and submarines would be nuclear-powered. However, with respect to escort ships--general purpose destroyers and

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[1]"Navy to Ask Congress for $1 Billion Ship," Los Angeles Times, December 12, 1971, p. A1.

[2]"Legislators Voice Concern at Nuclear Ship Lag," Armed Forces Journal, September 21m k857, p. 21.

guided-missile ships--"we believe that a mix of conventionally-powered and nuclear-powered is the way to go about it. This represents a proper balance between cost and what we get for the cost."[1]

If the United States holds to the policy of giving nuclear propulsion to all new carriers, submarines, and some escort vessels (which it has since Secretary Ignatius' statement), it will eventually come closer to having a "nuclear" Navy than at present, simply because all vessels now in service will eventually become obsolescent and will have to be decommissioned, although they might not necessarily be replaced. Of course, if the United States chooses to alter this policy by providing all escorts with nuclear propulsion, for example, or to extend the use of nuclear propulsion to various types of logistics ships, to take another example, it will eventually come very close to possessing what truly can be called a "nuclear" Navy.

How such questions and issues will be dealt with presently and in the future is certainly not clear. The Nixon administration has not drastically changed the basic defense policies espoused by Robert S. NcNamara, and it is likely that at least vestiges of what might be called the "McNamara" approach will remain operative for some time to come.

The "McNamara" approach is one of the major characteristics of recent Department of Defense history and involves the use of

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[1]U. S. Congress, House, Committee on Appropriations, Hearings, Department of Defense Appropriations for 1969, Part 6, 90th Congress, 2nd Session, p. 323.

cost-effectiveness/systems analysis (CESA). The intricacies of CESA and its applications are manifold, and much work that has been done with it has been and remains classified. However, CESA and certain related issues intimately tied to current policy toward nuclear-powered naval vessels can and should be analyzed in broad form, with particular attention given to the objectivity (or lack thereof) of the bases utilized in these studies.

To these ends, this study shall attempt to show what effect recent policies regarding nuclear vessel authorizations have had toward eventual establishment of a nuclear-powered fleet in the United States Navy.

Purpose of the Study

This subject has been of particular concern and interest to the author since serving as the Supply Officer of a nuclear-powered guided missile frigate, USS Bainbridge (DLGN-25). Having previously served in several conventionally-powered ships, there were many apparent advantages personally observed in the Bainbridge which raised the question of why there were not more nuclear ships in the fleet. The purpose of this study will be to analyze recent policies of the Congress and Department of Defense concerning authorizations of nuclear-powered vessels and determine why this superior propulsion capability has not been more widely utilized in United States Naval vessels.

Scope of the Study

This study will investigate Congressional and Department of

Defense policies regarding authorizations of nuclear-powered vessels, as previously stated, with particular attention devoted to the role played by CESA in the formulation of these policies. Since the quantitative data input to CESA studies are classified, the question of cost effectiveness will be dealt with in principle as to its relevance and applicability to nuclear propulsion.

Research Methodology

Data has been obtained for this study through the use of library research. Reference material has been obtained from public, educational, and military libraries in the metropolitan Washington, D. C. area. Particularly valuable assistance has been obtained at the Naval Supply Systems Command library and the Library of Congress.

The methodology used is the collection, analysis, and evaluation of the data pertinent to the problem. The analysis is primarily deductive and any statements or conclusions reflect those of the author and not of the Department of Defense or the Department of the Navy.

Terminology

Every attempt has been made to permit this study to be understandable to a reader who has neither a Navy background nor a knowledge of nuclear propulsion. Acronyms are utilized, but only after their parenthetical introduction following a full title, name, or concept to which they apply.

Organization of the Study

Chapter Two provides historical and background information on the U. S. Nuclear Navy. Any study dealing with nuclear propulsion will of necessity include a great deal of the thoughts and comments of Vice Admiral Hyman G. Rickover, who is the "Father of Nuclear Power" in the United States Navy. For this reason, a profile of Admiral Rickover precedes the compilation and analysis of previous authorizations.

Chapter Three discusses recent Department of Defense policies toward nuclear propulsion, with particular emphasis placed on the roles played by Robert McNamara and his successor, Melvin Laird, in formulating and enforcing these polcies. Some of the data presented will show the magnitude of differences which have existed, and still exist, between the Department of Defense policymakers and members of Congress.

One of the most important factors involved in studying nuclear vessel authorization hinges on the CESA studies conducted by the Department of Defense. Chapter Four explains some of the reasons why CESA was introduced into the Department of Defense and then questions the relevance and applicability of CESA methods as they have been applied to naval nuclear propulsion.

Chapter Five briefly summarizes the major conclusions which the author has drawn from the research process. It concludes the study with a few general thoughts on possible future steps.

Security Classification

All material included in this study is designated UNCLASSIFIED.

CHAPTER II

BACKGROUND AND HISTORY

Vice Admiral Hyman G. Rickover--A Profile

The history of nuclear propulsion in U. S. Navy ships and submarines can be traced back approximately twenty-five years. After World War II, the heads of the Manhattan Project turned their resources and energies toward peaceful applications of the atom. In 1946, they invited representatives of the Navy Department and private industry to participate in a project whose aim was the development of a practical means of producing commercial electrical power from a chain-reacting uranium pile.[1]

One of the men who went to the Oak Ridge laboratories to work on the Daniels Power Pile (as the project was known) was Captain Hyman G. Rickover. An engineering specialist who was a graduate of the U. S. Naval Academy Class of 1922, Rickover had served in a variety of ships and submarines. During World War II, he had gained some notoriety by the devastating and often unpopular efficiency with which he ran the

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[1]Commander James Calvert, USN, Surface at the Pole (New York: McGraw-Hill Book Co., Inc., 1960), p. 16.

electrical desk at the Navy's Bureau of Ships.[1]

Commander James Calvert, USN, who was the commanding officer of the USS Skate, the atomic submarine which surfaced at the North Pole in 1958, relates the following concerning Rickover's experience at Oak Ridge:

> . . .[He] soon saw that the Daniels Power Pile Project itself was not going to amount to much for reasons both technical and political. He saw, however, other possibilities in the newly unleashed force of the atom. Rickover had long been impressed with the potential importance of the submarine if it could be freed from its technical limitations. It appeared to him that atomic power was the key to what he sought. Before long he was obsessed with the idea of developing a submarine driven by a uranium pile.[2]

Faced with many obstacles in addition to the more obvious ones of a scientific and technical nature, the then Captain Rickover returned to Washington with no position, no money and no authority. As Calvert said, "All he had was a great idea, ruthless determination and courage. For eight years he talked, argued, bluffed, schemed and fought."[3]

Unfortunately for Rickover, the battles he fought did not go without consequences. In mid-1952 his career seemed to be at an end, as the Navy's selection board had passed him over for promotion to Rear Admiral for a second time.[4] This disappointment occurred almost

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[1] Ibid.

[2] Ibid.

[3] Ibid., p. 17.

[4] Charles W. Corddry, "Profile: Vice Admiral Hyman G. Rickover," Navy, The Magazine of Sea Power (February, 1970), p. 47.

simultaneously with the keel-laying ceremonies for the world's first nuclear-powered submarine, the Nautilus, on June 14, 1952.

Rickover had received accolades from the Navy Department in the form of a Legion of Merit award, citing him as more responsible than anyone for "rapid development of the nuclear ship program," in spite of "discouraging frustration and opposition".[1] In addition, Secretary of the Navy Dan A. Kimball had stated at the keel-laying ceremony that "Rickover has accomplished the most important piece of development work in the history of the Navy."[2]

Almost immediately a great deal of vocal displeasure with Rickover's misfortune began to come forth from Capitol Hill. Eventually, the White House and the new Secretary of the Navy, Robert B. Anderson intervened and Rickover was selected to Flag rank in 1953.[3]

Admiral Rickover quickly gained the reputation of a taskmaster whose hallmark was perfectionism, possessed with a compulsion to get the job done flawlessly. He detests slipshodiness and what he considers "an unrelenting intolerance of the rigamarole of Defense Department 'managers' which, as he sees it, gets in the way of the real work to be done."[4]

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[1] Corddry, "Profile," p. 47.

[2] They Fought Under the Sea, compiled by the editors of Navy Times (Harrisburg, Pa.: The Telegraph Press, 1962), p. 156.

[3] Corddry, "Profile," p. 47.

[4] Ibid.

An outspoken critic of the Defense Department, he is particularly caustic about systems analysis and "management that can't manage." This bluntness and amazing power to drive toward results have made him a power attentively listened to and admired on Capitol Hill.[1]

According to Edward L. Beach, the famed submariner, there is one thing about Rickover which is predictable. He depicts this predictability as:

> ". . . insistence upon the most thorough training, the most complete familiarity with operational and design procedures, the most complete familiarity with operational and design procedures, the most meticulously careful engineering practice by the designers, builders and personnel who operate nuclear machiner . . . this perfectionism is attained by vigilance on the part of all personnel involved--and of all of them, the most vigilant is Vice Admiral Rickover himself. . ."[2]

Long past retirement age, the "Father of the Nuclear Submarine" has just begun another two year tour as a retired officer recalled to active duty in the unique position of Assistant Commander for Nuclear Propulsion, Naval Ship Systems Command, and Chief, Naval Reactors Branch, Atomic Energy Commission.

He is deeply concerned about the progress the Soviets have made in submarine and surface ship development and is anxious to press ahead with high-speed and quieter submarines, and nuclear surface ships. As Corddry related, "Whoever stands in the way is the enemy, and Rickover

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[1] Ibid., pp. 47--48.

[2] Ibid., p. 48.

has accumulated more than a few of those."[1] His task has not been easy and undoubtedly his philsophy is best depicted by a famous Shakespearean quote which Commander Calvert noticed hanging in his office:[2]

> Our doubts are traitors,
> And make us lose the good we oft might win
> By fearing to attempt.

Seldom has Admiral Rickover feared to attempt!

Previous Authorizations

Admiral Rickover and other military leaders who could see the ultimate benefits of nuclear propulsion were able to convince influential members of Congress to authorize the development of a prototype reactor for testing in the desert near Pocatello, Idaho, with parallel development of an identical workable reactor for submarines.[3]

As a result of the work accomplished with the prototype in Idaho, Congress authorized the first attack nuclear submarine (SSN) in fiscal year 1952 (FY 1952.) The first ballistic missile submarines (SSBN) were authorized in FY 1958. The authorizations of SSN's and SSBN's from FY 1952 to FY 1970 are outlined in Table 1.

Of the total 110 authorized and funded by the Department of Defense through FY 1971, 46 SSN's and all 41 SSBN's were operational in February 1970 and an additional 19 SSN's were under construction or had contracts awarded for their construction. The three FY 1970 SSN's

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[1] Ibid., p. 47.

[2] Calvert, Surface at the Pole, p. 19.

[3] Fay, "Past--Present--Future," p. 15.

TABLE 1

NUCLEAR SUBMARINE AUTHORIZATIONS

Fiscal Year	SSN	SSBN
1952	1	
1953	1	
1955	2	
1956	3	
1957	6	
1958	4	3
1959	5	
1960	4	6
1961	1	10
1962	3	10
1963	8	6
1964	6	6
1965	6	
1966	6	
1967	5	
1968	2	
1969	2	
1970	3	
TOTAL	68	41

Source: U. S. Congress, House, Committee on Armed Services, Report of the Special Subcommittee on Composition of the Fleet and Block Obsolescence of Naval Vessels. (87th Congress, 2nd Session, p. 7241); U. S. Congress Committee on Armed Services, Reports No. 62 and 289 (88th Congress, 1st Session), 1138 and 1213 (88th Congress, 2nd Session), 271 and 374 (89th Congress, 1st Session), 1536 and 1679 (89th Congress, 2nd Session), 221 and 270 (90th Congress, 1st Session), 1645 and 1869 (90th Congress, 2nd Session) and 522 and 574 (91st Congress, 1st Session) U. S. Congress, Senate, Committee on Armed Services, Report No. 123 (88th Congress, 1st Session), 876 (88th Congress, 2nd Session), 144 (89th Congress, 1st Session) 1136 (89th Congress, 2nd Session), 76 (90th Congress, 1st Session), 1087 (90th Congress, 2nd Session) and 1716 (91st Congress, 1st Session).

were of the new High Speed Class and contracts were awarded in FY 1972.[1]

Although the road to success for the nuclear submarine has been difficult and not yet to the complete satisfaction of Admiral Rickover, when compared to nuclear surface ships, its success has been phenomenal. (Some of the recent difficulties and policies will be the subject of the following chapter in this study.)

Four nuclear-powered surface ships are currently operating in the United States Navy:

a. Long Beach, a guided missile cruiser (CGN), which was authorized in FY 1957.

b. Enterprise, an attack carrier (CVAN), which was authorized in FY 1958.

c. Bainbridge, a guided missile frigate (DLGN) which was authorized in FY 1959.

d. Truxtun, a DLGN, which was authorized in FY 1962.

In FY 1963 an additional DLGN was authorized, but construction was cancelled by the Department of Defense because of "slippage" in the development of the TYPHON air defense system with which she was to be armed. A DLGN was authorized in FY 1966 but construction was deferred by the Department of Defense. In FY 1967, this authorization was extended and the construction of the DLGN-36 was approved by the Department of Defense. Subsequently named the California, the DLGN-36 is expected

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[1]U. S. Congress, House, Committee on Appropriations, Hearings, Department of Defense Appropriations for 1969, Part 7, 91st Congress, 2nd Session, p. 10. SSN Scorpion was lost at sea in May 1968.

to join the fleet in late 1972 and her sister ship, the South Carolina, authorized in FY 1968, is due to be delivered in September 1973.[1]

Congress appropriated funds in fiscal years 1970 and 1971 for construction of the first two ships of the new design DLGN 38 class, and approved long leadtime funds for three more ships.[2]

A CVAN (subsequently named the Nimitz) was authorized in FY 1967 and, although originally planned for completion in FY 1972, will not be delivered until September, 1973. The Nimitz' sister ship, the Dwight D. Eisenhower was authorized in FY 1970, with an original planned delivery date of March, 1974. However, because the Eisenhower is being built in the same shipyard facilities as the Nimitz, and the ships are built in series, there is a delay in the Eisenhower's deliver until June, 1975.[3]

A third Nimitz class carrier, the CVAN-70, was originally scheduled for delivery in 1976. However, long leadtime components were requested in FY 1970 and were not included until the FY 1973 budget request. Now the current anticipated delivery date for the CVAN 70 is late 1980.[4]

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[1]U. S. Congress, House, Committee on Armed Services, Hearings on Military Posture, 88th Congress, 1st Session, p. 442, 90th Congress, 2nd Session, p. 8538; Hearings,, Department of Defense Appropriations for 1969, Part 6, pp. 311--313.

[2]U. S. Congress, Joint Committee on Atomic Energy, Hearings, Naval Nuclear Propulsion Program--1971, 92nd Congress, 1st Session, p. 71.

[3]Ibid., pp. 58, 60, 71.

[4]Ibid., p. 61.

Operating Record of Nuclear Vessels

Appearing before the Joint Committee on Atomic Energy in March, 1961, Admiral Rickover presented a summary of the performance record of nuclear-powered vessels to that time. When the 839th successful Polaris Submarine patrol was completed in November, 1970, it marked the 10th anniversary of the initial Polaris patrol by the George Washington. During that 10-year period, Polaris Submarines completed more than 50,000 days on submerged patrol or an equivalent in excess of 135 years underwater.[1]

The cumulative distance steamed by all nuclear-powered vessels at that time was over 17 1/2 million miles, which included 1 1/2 million miles steamed by the four nuclear-powered surface ships. The Enterprise alone, in her first nine years in commission, steamed over one-half million miles, including four deployments off Vietnam, and this feat was accomplished without having to be refueled.[2]

When Enterprise completed a shipyard period in 1970, she was refueled and the fuel life was increased from ten to thirteen years with the installation of a new design long-life reactor core. The cruiser Long Beach entered the ship yeard in 1971 after completing her third deployment to Southeast Asia and also was outfitted with the new long-life cores.[3]

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[1] Hearings, Naval Nuclear Propulsion Program--1971, p. 2.

[2] Ibid., pp. 2--3.

[3] Ibid., p. 3.

During Long Beach's eight month deployment to the Western Pacific in 1966--67, had the ship been powered by conventional fuel, 27 days over that actually required with nuclear power would have been required to make transits involved in replenishment operations. By not having to make those transits, Long Beach was able to spend that time in her assigned station.[1]

The Secretary of the Navy, in a speech to the Navy League in Chicago on October 27, 1967, praised the accomplishments of the then three operating nuclear surface ships citing the following advantages of nuclear power:

> Enterprise and Long Beach have shown the ease with which nuclear-powered ships can steam at speeds of more than 30 knots for indefinite periods; permitting the prompt deployment of naval offensive power to any point of need. Last June, when it was possible that naval forces would be required in the Read Sea, Enterprise and Long Beach, then in the South China Sea, could have been placed on station in the Suez Canal area within a period of about 1 week. Conventionally powered ships that were available, including supporting fleet orders, would have taken almost twice that time. . . . The payoff in a Navy properly balanced with nuclear power is high. All of the traditional characteristics of Naval power are enhanced. An offensive striking force may be placed quickly anywhere in the world where the oceans and seas allow. . . You can see from these statements that the Enterprise, Long Beach, Bainbridge and Truxtun are continuing to demonstrate their superior capabilities.[2]

The accomplishments of nuclear powered vessels are readily accepted by most authorities and yet the replacement of obsolescent

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[1] U. S. Congress, Joint Committee on Atomic Energy, Naval Nuclear Propulsion Program--1967--68, Hearings, 90th Congress, 1st and 2nd Sessions, p. 151.

[2] Ibid., pp. 153, 155.

conventional ships with nuclear-powered ships has moved at a slow pace. Chapters Three and Four will highlight some of the reasons for this lag.

CHAPTER III

RECENT POLICY TOWARD NUCLEAR-POWERED NAVAL VESSELS

McNamara/Clifford Era

Testimony given to Congress in 1968 by Secretary of the Navy Paul R. Ignatius, enunciated the policy of making selective use of nuclear propulsion for naval vessels--giving nuclear propulsion to all new carriers and submarines, and to some escort vessels. On April 30, 1968, Secretary of Defense Clark M. Clifford, presented to the House Armed Services Committee the last military posture statement prepared by his predecessor, Robert S. McNamara--"The Fiscal Year 1969--1973 Defense Program and 1969 Defense Budget." Secretary Clifford indicated that he fully supported Mr. McNamara's statement, with the only exceptions involving responses to the Tet offensive in South Vietnam and the seizure of the Pueblo.[1]

Mr. McNamara's posture statement explained the following with regard to submarine construction:

> The POLARIS-POSEIDON program [for the FY 1969--1973 period] is essentially the same as the one I presented here [before Congress] last year. Thirty-one of the 41 POLARIS submarines [SSBN's],

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[1] Hearings on Military Posture, 90th Congress, 2nd Session, p. 8597.

all of which have now become operational, will be refitted with the POSEIDON [MIRV, or multiple independently targetable re-entry vehicle] missile. The other ten (five 598-Class and five 608-Class) cannot be refitted without replacing the center section of their hulls. The cost would be about equal to that of a new submarine, and even then they would not be as good as the other 31. Accordingly, these submarines will continue to carry the POLARIS missile. The five 598-Class ships, which originally carried the A-1 [Polaris missile], have already been refitted with the A-3. The five 608-Class ships, which now carry the A-2, will be refitted with the A-3 during their second overhaul. The proposed FY 1969 shipbuilding and conversion program included funds for six POSEIDON conversions and advance procurement for nine more. . . .

We have now concluded that 60 "first class" SSN's will be sufficient rather than the 64 previously planned. A total of 66 SSN's have been funded through FY 1968, or which one was lost, and nine are no longer considered 'first class' (although they can be used for other purposes), leaving a total of 56 SSN's available for 'first class' missions. Thus only four more SSN's are needed. We now propose to start two in FY 1969 and two in FY 1970 (Advance procurement funds for the latter are included in the FY 1969 request). This schedule will maintain the option of continuing the SSN construction program if new conditions should warrent. The Navy is also investigating the characteristics of new submarines which may be required to meet the potential threats of the late 1970's.

In addition to the SSN's, we currently plan to retain a sufficient number of conventional submarines to maintain the force at 105 ships.[1]

On July 12, 1968, the New York Times reported:

Secretary of Defense Clark M. Clifford announced today that the Navy would proceed to build one of the two advanced types of nuclear submarines long urged by Vice Admiral Hyman G. Rickover to combat a growing Soviet submarine threat.

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[1] Ibid., pp. 8513--8514, 8541.

> The authorization, disclosed at a news conference, was for a 'super high speed' submarine. Mr. Clifford said a so-called 'quiet' submarine, driven by electric power, was still under consideration.[1]

Subsequently, on October 25, 1968, Secretary Clifford announced that the United States would build a $150 to $200 million "quiet" nuclear-powered submarine. As the Washington Post commented:

> One countermove to the growing Soviet missile fleet is for the Navy to build a lot of killer submarines so quiet that they can sneak up on other subs without being heard. But, Secretary Clifford yesterday did not opt for this program in deciding to build the Rickover "quiet" submarine. It will not be a whole new class of killer sub, but a one-of-a-kind demonstration project.[2]

Mr. McNamara's 1968 military posture statement went on to explain the following concerning attack carrier forces:

> Our concept of the optimum size and configuration of the attack carrier forces has continued to evolve over the years in the light of new analyses and additional experience. In FY 1963, for example, our plan called for a force of 15 CVA's [attack carriers] and 15 air wings. In FY 1967, while retaining the 15 CVA's in the fleet, we decided to reduce the number of aircraft to 12 equivalent wings, believing it was not necessary to procure aircraft wings for the number of carriers which would normally be in overhaul.
>
> As shown in the classified table provided the Committee, the attack carrier force at the end of the current fiscal year [1969] will compromise the nuclear-powered ENTERPRISE, seven FORRESTAL, two MIDWAY, and five HANCOCK/ESSEX-class carriers plus one carrier (MIDWAY) in conversion. The newest in the conventionally-powered CVA's, the JOHN F. KENNEDY, was launched this past year and is scheduled to enter the fleet in early 1969. A second nuclear-powered carrier, the CHESTER W. NIMITZ, is currently under construction and scheduled to join the fleet in FY 1972. The NIMITZ will be powered by a highly efficient two-reactor propulsion plant and as a

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[1] Washington Post, October 26, 1968, p. A6.

[2] New York Times, July 12, 1968, p. 1.

result of extensive automation will require a considerably smaller crew than its predecessor, the ENTERPRISE.

As I have stated in past years, we plan to replace all the old ESSEX-class CVA's, building to a force of four nuclear-powered ships, eight FORRESTAL and three MIDWAY-class carriers. Two additional CVAN's, therefore, still remain to be built The estimated cost of the NIMITZ has risen 28 percent over to 96 percent more than the $277 million cost of the KENNEDY. The price for the next CVAN promises to be at least as high as the NIMITZ. In order to keep the cost of the two additional CVAN's as low as possible, we are considering designing all three as identical ships, permitting a savings of about $35 million on each of the last two ships. We are also studying whether the first two can be procured under a multi-year contract, with options for a third in FY 1971--in order to take advantage of the cost saving potential inherent in this type of procurement. Due to the exceptionally long leadtime required for nuclear components, we have been able to defer the major portion of the funding for the next CVAN to FY 1970, including in this budget request additional advance procurement funds primarily to continue work on the nuclear power plant.[1]

On March 25, 1968, Secretary Clifford submitted a memorandum to President Johnson which outlined the Department of Defense policy toward nuclear escorts at that time. In the memorandum he referred to the fiscal year 1967 authorization bill which contained a requirement that "The Secretary of Defense and the Secretary of the Navy shall proceed with the design, engineering, and construction of the two nuclear-powered guided-missile frigates as soon as possible."[2] Although the Department of Defense objected to the mandatory language

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[1] Hearings on Military Posture, 90th Congress, 2nd Session, p. 8537--8539.

[2] Hearings, Department of Defense Appropriations for 1969, Part 6, p. 311. Secretary Clifford's Memorandum is reprinted in its entirety as Appendix A.

of the bill, it was enacted with a requirement that the construction of the DLGN-36 would be contracted for ". . . as soon as practicable unless the President fully advises the Congress that its construction is not in the national interest."[1]

At the time of Clifford's memorandum, construction of the DLGN-36 was approved and contracting action had begun. However, another bill had been enacted calling for the construction of the DLGN-37 and DLGN-38, with the same type of mandatory language requiring the President to "fully advise the Congress. . . not in the national interest."

The Navy had recommended several alternatives to the construction of both the DLGN-37 and DLGN-38. One of these alternatives would have called for the construction of the DLGN-37, but instead of continuing with futher construction of the other proposed ships in that class, it recommended building four of a new class nuclear escort which was tenatively called the DXGN. The DXGN would have been smaller ship and cost $40--50 million less. It also would have been equipped with one missile system rather than the two found in the DLGN. However, Clifford saw this as an opportunity to continue with construction of nuclear-powered escorts, which the Congress remained so adamant about, at a considerable savings.[2]

Viewed as a single purpose ship, i. e., a nuclear carrier escort, the DXGN would have been adequate with her single missile system.

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[1] Ibid.

[2] Ibid., pp. 312--313.

However, Clifford realized that there would be occasions when nuclear escorts would be required for other missions which would make two missile systems desirable, but concluded that the existing nuclear surface ships would be adequate for the task.[1] He therefore concluded that he believed that " . . . we do not need DLGN-38, and that we should complete two all-nuclear attack carrier task groups by building DLGN-36 and DLGN-37, followed by four DXGN's, the first two in fiscal year 1970, and the last two in fiscal year 1971."[2]

In summary, he told the President:

> I conclude that proceeding with the construction of the first of the two frigates (DLGN-37) authorized in Public Law 90-22 would be in the national interest, but that construction of the second (DLGN-38) would not. If you agree with that conclusion I recommend that you sign the attached Memorandum of Determination. Compliance with the statute will be accomplished by notification to the President of the Senate and the Speaker of the House by me on your behalf.

The Secretary's recommendation was approved by the President on March 29, 1968.[3]

In brief, the information presented to Congress by Secretary of Defense Clifford disclosed plans extending through the FY 1969--1973 period that no more SSBN's would be built. After FY 1969, there were plans for only two more SSN's having to be authorized and funded, although he desired to retain the option of continuing the SSN program

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[1] Ibid., p. 312.

[2] Ibid., p. 313.

[3] Ibid.

if "new conditions should warrant." (Subsequent to Secretary Clifford's April 30, 1968 presentation to Congress, it was announced that the Department of Defense would build a "super high speed" and a "quiet" nuclear attack submarine.) Two more CVAN's were scheduled to be built, for a total of four. Finally, the possibility of constructing nuclear escorts for four all-nuclear attack carrier groups instead of for two groups was left open.

In an analysis of the FY 1970 budget proposed by President Johnson and of Secretary Clifford's January 15, 1969, statement on "The 1970 Defense Budget and Defense Program for Fiscal Years 1970--1974," the Staff of the Joint Committee on Atomic Energy reported that full funding of three high-speed attack submarines plus long leadtime funds for four more, and completion of funding for the CVAN-69 (but no long leadtime funds for the CVAN-70) were requested. The Staff went on to comment: "It is clear that the Department of Defense is holding to its position of last year that we provide nuclear escorts for only two nuclear carriers rather than for all nuclear carriers as recommended by the Navy, the Joint Chiefs of Staff, and the cognizant committees of Congress."[1]

As the McNamara/Clifford era drew to a close, it appeared that the policy for providing nuclear propulsion for aircraft carriers and

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[1] Congressional Record, February 7, 1969, p. E926.

submarines had at least evinced a committment to move ahead. However, if there were any substantial questions remaining it appeared that it was the decision affecting the propulsion of escort vessels that would eventually determine whether the United States would approach anything resembling a "nuclear navy."

The Congress had made its viewpoint explicit in passing the legislation authorizing construction of the DLGN's for fiscal years 1967 and 1968. Although Secretary Clifford had "won the battle" with his cost-saving DXGN proposal, time would show that the Congress was capable of insisting that its desires be adhered to in the strictest sense and utlimately would "win the war." Senator Henry M. Jackson (D-Wash.) summarized the feeling of many congressional leaders as follows:

> As far as the surface Navy is concerned, it has been a consensus largely of words; the surface nuclear construction record is bleak indeed. The goal of nuclear task forces built around attack aircraft carriers has been more honored in talk than construction. . . the proposition of nuclear power in our [surface ship] of tomorrow. . . is, simply, 'Full speed ahead!'[1]

Laird/Packard Era

When President Nixon took office in 1969, he referred to the five-year hiatus which had existed with regard to construction of nuclear-powered surface ships as "an abrupt default on the Eisenhower Committment for a nuclear-powered Navy."[2] Unfortunately, his concern was not immediately transmitted to or understood by the Department of

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[1]Henry M. Jackson, "Congress Sparks Revival of Nuclear Surface Construction," Navy, The Magazine of Sea Power (Feb., 1970), pp. 24, 26.

[2]Hearings, Naval Nuclear Propulsion Program--1971, p. ix.

Defense higher echelon. It was only through the efforts of the Joint Committee on Atomic Energy, the House and Senate Armed Services and Appropriations Committees and the Congress as a whole that the Department of Defense was badgered into providing nuclear-powered submarines and surface ships in the numbers which the military leaders in the Navy and members of the Joint Chiefs of Staff felt necessary for the national defense.[1]

The President, in his Foreign Policy Report for the 1970's said:

> The overriding purpose of our strategic posture is political and defensive: to deny other countries the ability to impose their will on the United States and its allies under the weight of strategic military superiority. We must insure that all potential aggressors see unacceptable risks in contemplating nuclear attack, or nuclear blackmail, or acts which could escalate to strategic nuclear war, such as a Soviet conventional attack on Europe.[2]

With this goal in mind, and the obvious weakening of the superiority of the United States insofar as submarine strength is concerned, Congress and the Department of Defense were able to agree on the development of a new submarine program--the undersea longrange missile systems, or ULMS submarine. Funds were granted by the Department of Defense in FY 1971 for the design of the propulsion plan and this program appears to be progressing with joint support as evidenced by the inclusion of an $802 million budget authority request in the

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[1] Ibid.

[2] U. S. Foreign Policy for the 1970's, Report to the Congress by President Nixon, February 18, 1970, p. 122.

Fiscal Year 1973 Defense budget.[1]

For the apparent gains in the submarine area, nuclear propulsion took some backward steps with regard to aircraft carrier construction in FY 1970. The CVAN-70, third ship of the Nimitz class, was originally scheduled for delivery in 1976, based on a Navy request for advance procurement funds for long leadtime nuclear propulsion plant components in FY 1970. The delivery was delayed until 1977 when these funds were deferred to the FY 1971 budget request.[2] However, no funds were provided in either the FY 1971 or FY 1972 Defense Authorization Acts and as a result, the scheduled delivery has been delayed to late 1980, based on its inclusion in the FY 1973 budget request.

This delay in providing long leadtime funds has escalated the original estimated end cost of the CVAN-70 from $640 million to a present figure slightly less than $1 billion.[3] These cost escalations were outlined for the Joint Committee on Atomic Energy in 1971 by David T. Leighton, Associate Director for Surface Ships and Light Water Breeding Reactors, Atomic Energy Commission. Mr. Leighton explained that the increased costs would result from a disruption of CVAN nuclear component lines and also because the gap between the Eisenhower and the CVAN-70 would decrease the shipbuilder's efficiency in constructing these ships. He outlined various funding alternatives and their impact on CVAN-70 cost and delivery as presented in Table 2.

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[1] Congressional Quarterly, Vol. XXX, No. 5(Jan. 29, 1972), p. 173.

[2] Hearings, Naval Nuclear Propulsion Program--1971, p. 61.

[3] Ibid., pp. 59, 65.

TABLE 2

CVAN-70 FUNDING ALTERNATES

Required Funding $M FY 72	FY 73	FY 74	Total Estimated End Cost	Delivery Date	Basics
195	612	---	807	6/78	Nuclear Spares Utilized
139.5	203.5	482	825	6/78	Nuclear Spares Utilized
125	218	482	825	6/78	Nuclear Spares Utilized
---	299	652	951	9/80	Nuclear Spares NOT Utilized

Source: U. S. Congress, Hearing before the Joint Committee on Atomic Energy, Naval Nuclear Propulsion Program--1971, p. 63.

The Chief of Naval Operations and the Secretary of the Navy officially proposed that the Defense Department request $139.5 million in FY 1972 to provide long leadtime funds for CVAN-70. This plan, which could have been dunded by deleting from the FY 1972 budget some auxiliary ships of lower priority than the CVAN-70, would have allowed the Navy to utilize the Nimitz-class spare components at a saving of approximately $125 million. However, by delaying these funds until FY 1973, and the ultimate delivery of CVAN-70 to 1980, the Navy stated that it would not be prudent to divert Nimitz or Eisenhower spares to new ship construction in view of the length of time these two ships would have been operating by that time.[1]

Thus, as Admiral Rickover has pointed out, delaying procurement of long leadtime components, which take approximately seven years to manufacture, has escalated CVAN-70 end costs drastically. These escalations are mainly attributed to inflation, disrupted production lines with additional startup costs and an extended production schedule which adds to the shipbuilder's overhead costs and reduces his efficiency.[2]

Deputy Secretary of Defense Packard, in a letter to the Chairman of the Joint Committee on Atomic Energy stated that the Navy had proposed that ". . .the reprogramming of FY 72 funds be requested to procure long leadtime items for an additional nuclear powered

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[1] Ibid., p. 61.

[2] U. S. Congress, House, Department of Defense Appropriations for 1971, Hearings before a Subcommittee of the Committee on Appropriations, Part 7, 91st Congress, 2nd Session, pp. 43-44.

carrier (CVAN-70)." However, he added that "In order to keep the budget within reasonable limits, we concluded that there were other items that had a higher priority and, therefore, we did not make such a request." He further explained that "As Secretary Laird has said in congressional testimony, we believe we may need one or more additional nuclear carriers . . .[but] we believe that on balance it is desirable at this time to postpone the construction of an additional nuclear carrier."[1]

Mr. Packard's reference to keeping the budget "within reasonable limits" really was not applicable in this case as the Navy was recommending a change to the FY 1972 Shipbuilding and Conversion, Navy budget request by deleting a replenishment oiler and three salvage ships at a value of approximately $139.5 million and the addition of an equal amount for the CVAN-70 long leadtime components.[2] There would have been no net increase in the Defense budget.

Furthermore, Mr. Packard said that Secretary Laird and he believed that "we may need one or more . . .nuclear carriers." However, Secretary Laird on several occasions categorically stated that the CVAN-70 was required.[3]

There were several other conflicting views within the Nixon administration which led to the eventual exclusion of the funds in

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[1] Hearings, Naval Nuclear Propulsion Program--1971, p. 70.

[2] Ibid., p. 64.

[3] Ibid., pp. 53, 57.

Fiscal Years 1971 and 1972. Representative Rivers, in a floor debate in September, 1970 stated:

> In an unusual move, the administration while asking for the funds in the budget request, stipulated the decision to build the carrier not be made until a study by the National Security Council was completed on future carrier requirements.[1]

The House included the funds in FY 1972, but the Senate deleted them. The Joint House-Senate Subcommittee on CVAN-70 reaffirmed the need for the carrier but took the Senate's viewpoint and did not authorize funds because of the lack of a firm and unconditional budget request on the part of the executive branch.[2]

In January, 1972, Assistant Secretary of Defense Robert C. Moot said that although the Navy would not request specific authorization for the program until FY 1974, that $299 million in budget authority for CVAN-70 lon leadtime funds was included in the FY 1973 budget.[3] Only If the Congress takes action to ensure that long leadtime component procurement is effected in FY 1973 does it appear that the CVAN-70 will meet its already-delayed delivery date of 1980, and almost assuredly will exceed the presently projected end cost of $951 million.

With regard to the nuclear frigate program, the Congress took the most unusual step of requiring in the law that authorized

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[1] Ibid., p. 57.

[2] Ibid., p. 143.

[3] Congressional Quarterly, Vol. XXX, No. 5 (Jan. 29, 1972), pp. 173-74.

construction of the DLGN-36 and DLGN-37 that the contracts for those ships "shall be entered into as soon as practicable unless the President fully advises the Congress that its construction is not in the national interest."[1] This strong action appears to have been the result of Congressional frustration with the executive branch in its delaying tactics over the years in executing the policy of the Navy and the Congress that all four nuclear carriers should have nuclear escorts, rather that providing them just for Enterprise and Nimitz as previously planned by Secretary Clifford.

At the keel laying ceremony for the California (DLGN-36) in January, 1970, Secretary Laird indicated his strong support for the nuclear frigate construction program which would include the two DLGN-36 class and five DLGN-38 class ships. He stated that:

> . . .we are building nuclear-powered frigates for the Navy of the 1970s, the 80s and 90s. The California will be the first such ship of seven which have been authorized by the United States Congress. . .the additional radius which the California and her successors will provide will be of great value to the defense of our country. . .."[2]

Vice Admiral Rickover, in testifying before the Joint Committee on Atomic Energy in March, 1971, said that the Navy should build at least two nuclear frigates per year, rather than the one per year currently planned.[3] The Navy's goal, as previously stated, is to have

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[1] Hearings, Department of Defense Appropriations for 1971, p. 58.

[2] Hearings, Naval Nuclear Propulsion Program--1971, p. xvii.

[3] Ibid., p. 71.

nuclear escorts for all nuclear-powered carriers. Rickover's proposal, as depicted in Tables 3 and 4, will provide these escorts four years earlier than presently planned. In substantiating his recommendation, Rickover pointed out the following specific advantages of nuclear-powered frigates as opposed to their conventional counterparts when operating with either a nuclear or conventional carrier:

(a) Nuclear-powered escorts can hold their anti-air or antisubmarine stations without periodic lowering of the task group's readiness while refueling;
(b) Unlike her conventionally powered counterpart, the DLGN can match the operating endurance of an enemy nuclear-powered submarine. This high-speed endurance of nuclear propulsion is becoming more important as the USSR continues to build nuclear-powered submarines and particularly as they appear to shift emphasis to anticarrier operations;
(c) Tanks now used in the carrier to store fuel for conventional escorts can be used for aircraft fuel, thereby increasing the carrier's capacity for continuous air operations;
(d) Faster response is available due to higher transit speeds, including the selection of advantageous routes;
(e) Earlier and more aircraft sorties can be flown as a consequence of being free of periodic escort fuelings;
(f) Continuous use of higher task group speeds is possible thereby permitting coverage of more territory and targets, being less vulnerable and more effective.[1]

The Joint Committee on Atomic Energy published the following at the conclusion of its hearings in March, 1971:

> It must be recognized that if we do not provide our Navy with the kinds of warships which can successfully counter the rapidly expanding Soviet naval threat, the United States will not have a credible capability to conduct overseas

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[1] Ibid., p. 72.

TABLE 3

DLGN DELIVERIES BASED ON 1 DLGN PER YEAR

CVAN	Delivery	Escorts	Delivery	Age of CVAN when escorts available
Enterprise	Nov. 1961	DLGN 25	Oct. 1962	12 years
		DLGN 35	May 1967	
		DLGN 36	Dec. 1972	
		DLGN 37	Sep. 1973	
Nimitz	Sep. 1973	DLGN 38	1974	3 years
		DLGN 39	1975	
		DLGN 40	1976	
		DLGN 41	-do-	
Eisenhower	Jun. 1975	DLGN 42	1977	5.5 years
		DLGN 43	1978	
		DLGN 44	1979	
		DLGN 45	1980	
CVAN 70	Jun. 1978	DLGN 46	1981	6.5 years
		DLGN 47	1982	
		DLGN 48	1983	
		DLGN 49	1984	

Source: U. S. Congress, Joint Committee on Atomic Energy, Naval Nuclear Propulsion Program -- 1971, Hearings, 92nd Cong., 1st Sess., p. 71.

TABLE 4

DLGN DELIVERIES BASED ON 2 DLGN's PER YEAR BEGINNING FY 1973

CVAN	Delivery	Escorts	FY Authorized	Delivery	Age of CVAN when escorts available
Enterprise	Nov. 1961	DLGN 25	1959	Oct. 1967	12 years
		DLGN 35	1962	May 1967	
		DLGN 36	1967	Dec. 1972	
		DLGN 37	1968	Sep. 1973	
Nimitz	Sep. 1973	DLGN 38	1970	1974	3 years
		DLGN 39	1971	1975	
		DLGN 40	1972	1976	
		DLGN 41	1973	-do-	
Eisenhower	Jun. 1975	DLGN 42	1973	1977	3.5 years
		DLGN 43	1974	1978	
		DLGN 44	1974	-do-	
		DLGN 45	1975	1979	
CVAN 70	Jun. 1978	DLGN 46	1975	-do-	2.5 years
		DLGN 47	1976	1980	
		DLGN 48	1976	-do-	
		DLGN 49	1977	1981	

Source: U. S. Congress, Joint Committee on Atomic Energy, Naval Nuclear Propulsion Program -- 1971, Hearings, 92nd Cong., 1st Sess., p. 71.

> military operations by any of the services in any area where the Soviets choose to exercise their naval power. . . We are a nation tired of fighting a protracted war against an ill-defined enemy. But we must not lose sight of the fact that while we have been pouring vast resources into the Vietnam conflict, the Soviet Union has been arming with modern weapons at an unprecedented rate. . .The Congress of the United States must again take the initiative to insure that we build nuclear-powered warships for our first line naval striking forces, and that the program for improving and building nuclear submarines is agressively pursued.[1]

Subsequent to the hearings, the Chairman of the Joint Committee on Atomic Energy received a letter form the Deputy Secretary of Defense stating that the Department of Defense had decided not to proceed with the construction of two of the nuclear frigates for which Congress had already appropriated advance procurement funds and for which machinery was already being fabricated.[2] Several questions arise concerning the consistency of Mr. Packard's rationale in this letter. First, he stated that "Before negotiations can proceed, a decision is needed on how many ships the contract should cover." Two months earlier Admiral Rickover testified that the Navy had already negotiated a contract for five ships, that the shipbuilder had signed the contract and the Navy had requested permission from the Department of Defense to countersign it.[3] Furthermore, Secretary Laird stated in a letter dated April 15, 1971, that the Department of Defense had reviewed the Navy-

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[1] Ibid., p. xxi.

[2] Secretary Packard's letter of May 5, 1971, is reprinted in its entirety in Appendix B.

[3] Hearings, Naval Nuclear Propulsion Program--1971, p. 74.

negotiated contract with a prospective contract award date of April 30, 1971.[1]

Mr. Packard further stated in his letter of May 5 that he was "especially concerned" over being committed to a multi-year contract for ships beyond those already funded or proposed to the Congress. His concern was aroused by the "significant increase in the cost of the DLGN-38 over earlier estimates." However, Admiral Rickover again related in his March testimony that "It is clear from the negotiations that the shipbuilder can and will construct these ships at a lower cost to the Government if they are bought on a five-ship basis. Further, the shipbuilder is willing to accept lower profit and ceiling price levels on a five-ship buy than if a smaller number of ships were bought.[2]

It appears that Mr. Packard decided to slow down construction of nuclear-powered frigates in spite of their lower cost per ship is built on a five-ship basis and in spite of Secretary Laird's earlier statements supporting construction of all five frigates.[3]

The present status of nuclear propulsion for escort vessels is that the Congress has approved total funding for the first three DLGN-38 class ships and contracts are being negotiated for their

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[1]Secretary Laird's letter of April 5, 1971, is reprinted in its entirety in Appendix C.

[2]Hearings, Naval Nuclear Propulsion Program--1971, p. 74.

[3]See Appendix C.

construction. However, there are no funds requested for the fourth ship in that class, DLGN-41, in the FY 1973 budget and although he has left the government, it appears that the Nixon administration is continuing the Packard policy regarding nuclear frigates.

Seldom have two men had such a definite and lasting effect on the formulation of policy as did McNamara and Packard. Only the test of time and the tenacity and power of Vice Admiral Rickover and the Congress of the United States will tell if these policies are likely to be overturned in the near future.

CHAPTER IV

COST EFFECTIVENESS AND NUCLEAR PROPULSION

Most of the questions and issues that have arisen over the type of propulsion to be utilized in escort vessels are bound up with cost effectiveness and systems analysis (CESA). This is perhaps to be expected, not only because CESA has been utilized to answer "strategic" questions such as the proper "mix" of conventional and nuclear powered escort vessels, but to fashion "implemental" policies such as "total package" procurement of escort vessels.[1]

What is CESA?

Cost effectiveness analysis and systems analysis have been defined by many as the same thing. However, there are equally as many authors who differentiate between these two terms. This study will make no distinction between them.

One of the most concise statements describing cost-effectiveness is offered by Klaus Knorr:

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[1] Hearings on Military Posture, 90th Cong., 2nd Sess., pp. 8538, 8543. It should be noted that the dividing line between strategic and implemental policies cannot be drawn easily and accurately, since there is reason to believe that procurement policy could foreclose or narrow strategic options.

> The cost-effectiveness technique compares alternative ways of accomplishing an objective in order to determine the solution that contributes the most at a given cost, or that achieves a given objective at the least cost.[1]

Dr. Alain C. Enthoven describes systems analysis (or cost effectiveness analysis) as ". . . nothing more than quantitative or enlightened common sense aided by modern analytical methods." He further states that systems analysis strives "to identify the alternative that yields a specified degree of effectiveness for a given cost."[2] In essence, what Enthoven and others envision with CESA is a system which will help to identify how best to utilize the limited national resources.

Although a discussion of CESA could be made into a review of United States defense policy in the last ten years, its use appears to have particularly manifest in formulating policy governing nuclear propulsion for surface vessels. However, prior to looking at the application of CESA to nuclear propulsion in some detail, it is believed that a short description of the rationale for introducing CESA within the Department of Defense in general would be beneficial.

Why CESA?

Armen A. Alchian, in pointing out defects in the methods utilized prior to the introduction of CESA in the Department of

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[1]Klaus Knorr, "On the Cost-Effectiveness Approach to Military Research and Development," Bulletin of the Atomic Scientists (Nov. 1966), p. 11.

[2]Alain C. Enthoven, "The Systems Analysis Approach," Program Budgeting and Benefit Cost Analysis, ed. H. H. Hinrichs and G. M. Taylor (Pacific Palisades, Calif.: Goodyear Publishing Co., Inc., 1969), p. 160.

Defense stated:

> . . .the old system of decisions [were] characterized by (a) incomplete, biased concepts of costs, (b) failure to properly categorize the item, service or program to be costed, (c) failure to consider trade-offs among programs, their components, and goals being sought led to what was believed to be inefficient military-defense programming and procurement.[1]

Further, Alain C. Enthoven, who in testifying before the Congress as the Assistant Secretary of Defense (Systems Analysis), stated that the Congress itself had been critical of the Department of Defense's budget process prior to 1961 and cited the following reasons:

(1) It was based on arbitrary and predetermined financial limits unrelated to strategy or need;
(2) It was done by objects of expenditure, unrelated to defense missions;
(3) It was a piecemeal, one-year-at-a-time effort without adequate attention to long-run consequences; and
(4) It paid insufficient attention to performance or effectiveness.[2]

Edward S. Quade, a prolific writer of material concerning CESA and one of its most articulate spokesman, stated that CESA:

> . . .in contrast to many of its alternatives, provides its answers by processes which are reproducible, accessible to critical examination, and readily modified as new information becomes available. At the very least, systems analysis can supply a means of choosing the numerical quantities related

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[1]Armen A. Alchian, "Cost Effectiveness of Cost Effectiveness," Defense Management, ed. by Stephen Enke (Englewood Cliffs, N.J.:Prentice Hall, Inc., 1967), p. 79.

[2]Claude Witze, "PPBS: Another Uncertain Trumpet?" Air Force and Space Digest, Vol. 51 (January, 1968), p. 32.

> to the weapon system in such a manner that they are logically consistent with each other, with the general objectives of warfare, and with the calculations expectation of the future.[1]

The proponents of CESA, both within and outside of the Department of Defense, argue that the elements of cost, quality and quantity must be quantified in order to aid a decisionmaker in selecting a proper alternative. It is argued that CESA will help him make a better decision as it will sharpen his intuition and broaden his judgment base. Cost analysis is a tool which will aid the decisionmaker's judgment.[2]

There are obvious shortcomings in looking to CESA studies as the panacea to the problems of national defense. Although the original stated purpose of CESA was to "assist the decisionmaker" there have been indications that saving money has become the real goal. Ralph Kenney Bennett, in an article entitled "The Worst Economy" suggested:

> . . .that cost analysis may have become a neams unto itself, that cost analysts in their zeal to save money may have become blinded to real and vital military exigencies. In short, cost-effectiveness may have become a mania.[3]

Admiral Rickover has echoed Bennett's observation many times in testifying before Congressional committees. For example, in an

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[1]Edward S. Quade, Military Systems Analysis (Santa Monica, Calif.: The RAND Corp., 1963), p. 28.

[2]Edward S. Quade, Introduction and Overview (Santa Monica, Calif.: The RAND Corp., 1965), p. 8.

[3]Ralph Kenney Bennett, "The Worst Economy," Data, Vol. 13 (December, 1968), p. 11.

appearance before the Senate Armed Services Committee in 1968 he stated that:

> . . .we have cost analysts in the Department of Defense whose stated function is to get cheaper, not better military weapons. . .. Their job is to reduce the cost of weapons; that is their sole job.[1]

In substantiating his claim, he cited the following reference to a document which was originated in the Office of the Secretary of Defense:

> . . .the request for proposal for the DX [a multipurpose destroyer under development] must emphasize, in specific terms, that the main goal of the program is not a major improvement in destroyer characteristics but rather a major reduction in life cycle cost.[2]

Doubts have been raised by many military men and legislators concerning the capability of some of the weapon systems which have been approved by the cost analysts. Bennett questioned whether these weapons systems will perform the mission required of them:

> . . .The F-111 is perhaps the most signal example. . . if the F-111 ever does meet its mission. . .it will be because economy has been thrown out the window. The cost of this plane continues to rise. Another dubious monument to cost effectiveness is the carrier USS John F. Kennedy. The fact that this great ship will go to sea with "economical" conventional engines instead of self-sustaining nuclear ones is an unhappy example of the fallacy of applying economics to a military weapon. Cost analysts will of

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[1]U. S. Congress, Senate, Committee on Armed Services, U. S. Submarine Program, Hearings, before a subcommittee of the Committee on Armed Services, U. S. Senate, 90th Cong., 2nd Sess, 1968, p. 24.

[2]Ibid., p. 51.

course remain unconvinced of this until this carrier has to pull of the line to refuel in battle conditions.[1]

Cost-Effectiveness and the CVA-67

The aircraft carrier CVA-67 was requested by the Navy and the Department of Defense for the fiscal year 1963 budget. Initially, the Navy recommended that the ship be nuclear-powered. However, after a great deal of hin-house battling, Secretary McNamara was able to convince Secretary of the Navy Korth and the Chief of Naval Operations, Admiral Anderson to change their recommendation from a nuclear-powered carrier to a conventional ship prior to submission of the budget request to the Congress. As a result, the CVA-67 was authorized and funded as a conventional carrier.[2]

An outline of the justification and rationale by which cost effectiveness and systems analysis have been and can be applied to the question of nuclear propulsion for surface vessels was provided by certain exchanges that took place during hearings held in 1963 by the Joint Committee on Atomic Energy, at a time when the Department of Defense was being urged to reconsider its decision to provide the attack carrier authorized in FY 1963--CVA-67 (subsequently named the John F. Kennedy)--with conventional rather than nuclear propulsion:

> . . . SENATOR HICKENLOOPER. Do I understand you, Mr. Secretary, to be saying in barnyard language that a truck on the farm that will get the grain to town and back in an acceptable period of

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[1]Bennett, "The Worst Economy", p. 11.

[2]Hearings, Naval Nuclear Propulsion Program, 1967--68, p. 115.

time at 30 miles an hour is just as efficient as a truck that can go at 80 miles an hour.

In other words, the extra 50 miles an hour possibility on that truck would not be of sufficient advantage to pay or to cause a requirement for that?

SECRETARY MCNAMARA. I think it is an excellent analogy, Senator. If I may expand on it slightly.

SENATOR HICKENLOOPER. Quite often the suggestions we make from this end of the table are excellent, I find in the record, but they are subject to testing, I know.

SECRETARY MCNAMARA. To expand on it just slightly, the farmer has a requirement for moving a certain quantity of grain to town. He has a truck that meets the requirement. It happens to move at 30 miles an hour and has these other characteristics.

Someone else comes along and says I have a better truck It will move at 80 miles an hour. You ought to have the best. Your farm and you do deserve nothing but the best. But he says I don't need the other 50 miles an hour. My grain is moved.

I therefore should not spend the money on that. There is no ceiling on expenditures for trucks. He has to move the grain. He would pay twice as much as the 30 mile an hour truck would cost if he would lose his harvest by not doing so. But he doesn't need to pay any more. His grain is moved. This is exactly the situation we are in. . . .

CHAIRMAN PASTORE. Mr. McNamara, if the Congress were prepared to give you the money you needed for a nuclear-propelled aircraft carrier, or give you the money you require for a conventional, which one would you choose? As the Secretary of Defense, which on would you take?

SECRETARY MCNAMARA. Today I would ask for the money for the nuclear-powered carrier and spend it for a conventional carrier plus additional costs.

CHAIRMAN PASTORE. You are not answering my question. I am not trying to be coy or cute about this. I am trying to get this confusion down to specifics. All I am asking you is this: Regardless of the expense involved, if the Congress were ready to give you the money that you needed for a conventional aircraft carrier, which one would you prefer to have as Secretary of Defense.

I think that is a simple question. Which one would you consider better?

> SECRETARY MCNAMARA. Let me say this. I would prefer, at equal cost, a nuclear carrier over a conventional.[1]

Mr. McNamara, when pressed further to explain what he meant by equal cost, utilized an analogy from his personal life in making the choice between buying a Lincoln or a Ford. He stated that:

> . . . when I expended funds equivalent to the cost of a Lincoln I considered what else I could do with it. In this particular instance a Ford met my needs. It transported me as fast as I wanted to go and with the comfort I was willing to accept and I found it desirable to use the extra funds elsewhere.[2]

It appears that Secretary McNamara had fallen prey to the "save money" syndrome which Bennett addressed earlier. There is little doubt that making the John F. Kennedy nuclear-powered would have added substantially to the capability of the fleet. It really was not a matter of "transporting . . . as fast as I wanted to go . . . " as Mr. McNamara said, but rather was accepting a less desirable strategic alternative because of cost.

As Admiral Rickover related to the Senate Subcommittee on National Security, the decision on this particular ship was delayed for a year while the Navy attempted to respond to a request to "undertake a comprehensive, quantitative study on whether the future Navy will, indeed, make full use of nuclear power. "[3] The Department of Defense

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[1]U. S. Congress, Joint Committee on Atomic Energy, Hearings, Nuclear Propulsion for Naval Surface Vessels, 88th Congress, 1st Session, pp. 164, 167--168.

[2]Ibid., p. 168.

[3]Hearings, Naval Nuclear Propulsion Program, 1967--68, p. 115.

asked a myriad of questions, each time one was answered, more were asked. The decision was finally made by the Department of Defense against putting nuclear propulsion on the John F. Kennedy in order "to avoid further delay in the construction of the ship," and Rickover then questioned ". . . is it really necessary to engage in cost-effectiveness studies on the whole future of the Navy before we can decide to put nuclear propulsion in a single ship?"[1]

Furthermore, an example of the Congressional displeasure with the ultimate decision to build the Kennedy with conventional power was expressed several years later by the Honorable L. Mendel Rivers:

> The other day the USS Kennedy was ordered to the Mediterranean. The USS Kennedy is McNamara's masterpiece. The USS Kennedy is an oil-burning carrier. The USS Kennedy should have been a nuclear carrier. Because the USS Kennedy had to refuel and had to travel at reduced speed, it took 2 days longer to get to its destination in the Mediterranean. . . The Kennedy is the newest carrier we have floating today and it is oil burning rather than nuclear powered -- it is a disgrace to the Department of Defense -- and it carries the name of a great American. It should have been a nuclear-powered carrier.[2]

Rivers went on to state that in a real war situation the additional two days transit time could have been decisive in battle and her tanker would have been a vulnerable target. He cites this as another example of the need for nuclear propulsion in our first line surface warships.

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[1]U. S. Congress, Senate, Committee on Government Operations, Planning--Programming--Budgeting, Committee Print, prepared by the Subcommittee on National Security and International Operations, pursuant to S. Res. 54, 90th Congress, 1st Session (Washington, D.C.: Government Printing Office, 1967), p. 43.

[2]Hearings, Naval Nuclear Propulsion Program--1971, pp. 147-148.

Relevance of CESA to Naval Nuclear Propulsion

Perhaps one of the stronger arguments--indeed, perhaps the ultimate argument--against the application of CESA to the problem of naval nuclear propulsion strikes at or very near the heart of this analytical approach. Admiral Rickover has stated: "To compare a larger number of conventional escorts with a smaller number of nuclear escorts at equal cost is not to compare alternate ways of achieving the same capability; it is merely two different capabilities that can be achieved with the same amount of money."[1]

In further comparing the relative cost of nuclear and conventional frigates and destroyers, Admiral Rickover cited a study conducted by the Center for Naval Analyses which concluded that a nuclear frigate over its life time would cost 1.2 times as much as a conventional frigate.[2] The calculations utilized in this study were checked and corroborated by an independent analysis conducted by the Office of the Assistant Secretary of Defense for Systems Analysis (OASD(SA)). The OASD(SA) study reported that initial and annual operating costs for a DLGN and a DLG, which on an undiscounted basis over a twenty to twenty-five year operating life, would show that a DLGN could be expected to cost 1.2 times a DLG. The study further noted that a possibility existed that a nuclear escort might cost less

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[1] Hearings, Department of Defense Appropriations, 1969, Part 6 p. 120--121.

[2] U. S. Congress, Joint Committee on Atomic Energy, Naval Nuclear Propulsion Program 1967--1968, Hearings, 90th Congress, 1st and 2nd Sessions, p. 430

than a conventional escort when used for independent operations in areas separated from normal logistic support facilities.[1]

The OASD study further showed that if the Navy were constrained to choose "between providing a given number of conventional ships and a smaller number of nuclear ships at the same cost," four nuclear escorts would be superior to an essentially equal cost of five conventional escorts.[2]

In a letter that he wrote to the Secretary of Defense on November 10, 1965, the then Chairman of the House Armed Services Committee, Honorable L. Mendel Rivers, took essentially the same position as Admiral Rickover:

> We (the House Armed Services Committee) specifically reject the idea that we must not build nuclear-powered warships because we could build more conventional ships with the same money. The U. S. Navy needs more warships with the unique capabilities provided by nuclear propulsion.[3]

The judgment that nuclear propulsion is unique is crucial, for if nuclear propulsion is in fact unique then the comparisons or tradeoffs between conventional and nuclear power that have been made through CESA are irrelevant to fashioning policy governing naval nuclear propulsion. According to Mr. Rivers, as expressed in his November 10 1965, letter, not CESA but a basically different approach should be employed in the making of decisions concerning nuclear propulsion:

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[1] Ibid.

[2] Ibid., p. 431.

[3] Quoted in Hearings, Department of Defense Appropriations 1969, Part 6, p. 120.

> Each class of naval warships should be designed to incorporate those capabilities that are consistent with a balanced ship design for that class of ship and that represent the best in each feature that our technology will allow. Then we should build as many of each class of ships as required to give the United States the needed balance of Naval power.[1]

Application of CESA to Naval Nuclear Propulsion

If, on the theoretical level, at the very least, CESA is applicable to problems raised by naval nuclear propulsion, then a proper question is--can such an application be improved? Certainly, one can accept CESA as a useful tool or as a way station on the route to improved analyses without denying its relevance to nuclear propulsion. In a 1966 article on nuclear propulsion for aircraft carriers, Luther J. Carter observed:

> Harold Brown, former director of defense research and engineering, expressed concern a few years ago that cost-effectiveness studies tend to evaluate the effectiveness of nuclear ships in terms of deployment concepts developed through years of experience with conventional ships. 'I think this prejudices the case against the all-nuclear Navy and prejudices it unfairly,' Brown said. 'It is just possible that entirely different concepts and tactics will evolve.'[2]

One criticism of CESA as applied to naval nuclear propulsion can be based on what might be called errors of omission. On May 1, 1968, D. T. Leighton, Associate Director for Surface Ships and Light Water Breeder Reactors, U. S. Atomic Energy Commission, told the House Defense Appropriations Subcommittee the following concerning the impact of

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[1] Ibid.

[2] Luther J. Carter, "Nuclear Carriers: Studies Convince the Skeptics", Science, March 18, 1966, p. 1371

systems analysis on defense programs:

MR. SIKES. Isn't it true that the systems analysis studies do not include many of the advantages of nuclear propulsion in the calculations?

MR. LEIGHTON. Yes sir. Many things cannot be put into these studies in numerical form and anything that doesn't fit the frame of the study is simply omitted. I will read you the list of advantages of nuclear power that were not considered in the major fleet escort study because they could not be put into numerical form. I will quote from the study itself.

> The following advantages were not quantified in the study:
> Increased tactical flexibility and freedom to conduct independent missions.
> Freedom from requirement to replenish in areas of high threat. In this study replenishment was conducted at strike station; that is, the replenishment forces delivered consumables to the carriers on strike station and it was assumed that no losses occurred during replenishment.
> Past studies have shown the advantage of the all-nuclear force if the carrier must transit to a replenishment area some distance from strike station.
> Enhanced opportunity to use evasive tacts.
> Improved capability to operate in bad weather or to take circuitous routes to avoid storms.
> Ability to extend attack along greater perimeter.
> Freedom from requirement to replenish in areas of high threat.
> Elimination from concern for loss of fuel oil facilities at source, prepositioned fuel depots, or en route to the refueling rendezvous.
> Capability, under very high threat and combat situations that have deteriorated seriously, to operate completely free of logistic support and be able thereby to cycle in high-speed transits to distant sources for ammunition and aviation fuel needed to continue in action.
> Ability to fulfill mission immediately on completing of high-speed transit or redeployment without replenishment.
> Release of man-hours to carry out other more productive duties as a result of eliminating of underway refueling."

No one has yet found a way to express the advantages of nuclear power I have just discussed in numerical form.

> Therefore, the analysts omit these advantages from their study results.[1]

Admiral Rickover in an appearance before the House Appropriations Committee in 1965 pointed to some of the dangers which exist if faulty assumptions are made in CESA studies:

> Cost effectiveness studies can assume that . . . we will have adequate advance bases. . . . They can assume that we will have no trouble maintaing a logistic supply line at sea. They can assume that we will not need sustained high speed. . . in our warships. They can assume all these things but they cannot insure them or in fact do anything to bring them about. . . . Once the assumptions are made, the possibility of these situations arising are removed from the decisionmaking equation.[2]

It is probably safe to assume that faulty assumptions will have a high probability of producing faulty conclusions. Again, Admiral Rickover addresses this point by stating:

> In my technical work one of the most important issues I face is the determination of those things which are properly subject to numerical analysis and those things which are not. Any mathematical calculation can only produce results within the framework of assumptions upon which the calculation is based. . . . The calculation results cannot take into consideration factors which are eliminated by the original assumptions.[3]

Cost analysts who are untrained in a technical area can produce a totally invalid decision by clouding the "facts" with preconceived opinions. In one of his most caustic attacks on CESA, Rickover charged:

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[1] Hearings, Department of Defense Appropriations for 1969, Part 6, pp. 103--104.

[2] U. S. Congress, Senate, Committee on Appropriations, Department of Defense Appropriations for 1966, Hearings, 89th Congress, 1st Session, 1965, p. 41.

[3] "Admiral Hits Cost-Effectiveness", Journal of the Armed Forces, Vol. 103 (July 30, 1966), p. 10.

> The social scientists who are responsible for the so-called cost effectiveness studies have little or no scientific training or technical expertise; they know little about naval operations. Their claim to authority is based on their social science, which has yet to prove itself a true science. The evidence has to be forced into the preordained frame they have devised, and when it won't fit, it is ignored altogether.[1]

In yet another criticism, Admiral Rickover offered a stinging appraisal of Department of Defense analysts:

> I have had some experience with DOD analysts. . . . I find them to be generall illiterate technically. This results in numerous meaningless studies which evade the basis issues and only cause delay--sometimes for years. . . . I know of no DOD study which has ever had a single effect on my programs, other than delay.[2]

Obviously some of Admiral Rickover's comments are the result of years of frustrating experience with CESA as it has been applied to nuclear propulsion. His criticisms of the very bases of the many studies which have been and are being conducted point to the fact that it is just possible that a way or a comparable, alternative methodology will emerge in considering the merits of nuclear propulsion.

Another means by which to improve the application of CESA to problems of nuclear propulsion would be to meet successfully the charge that CESA has too often ignored military expertness and insight based on hard experience gained through military operations. Carter has suggested that a fusion of CESA and military expertness is both necessary and feasible:

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[1]Naval Nuclear Propulsion Program, 1967--1968, Hearings, p. 105.

[2]U. S. Submarine Program, Hearings, p. 39.

> To many naval officers, the fact that the nuclear carrier has now received the blessing of favorable cost-effectiveness studies must seem of quite academic interest. The Navy reports that the Enterprise, operating off Vietnam in the South China Sea, has been launching 20 percent more attack sorties than the conventional carriers have been launching. The very circumstances which, two years ago, McNamara felt would be 'quite exceptional' have become routine since the raids on North Vietnamese and Viet Cong targets began in February, 1965. Carriers of the U. S. Seventh Fleet have been engaged in sustained combat operations and have required frequent replinishment. The Navy's analysis of the nuclear carrier's value--heavily influenced by the intuitive judgment of experienced naval officers--appears to have been better than the early judgments by McNamara and his analysts.[1]

According to Carter, it was the intuitive judgment of naval officers, combined with efforts on the part of the Navy to make CESA an integral part of its own development of naval programs, by which the Navy gained "further insight into the operational advantages nuclear power affords. The Navy's studies, which McNamara and his staff now find convincing on the whole, have indicated that the nuclear ship's principal advantage over its conventional counterparts of the same size is an ability to launch more sorties before having to 'go off the line' for replenishment of fuel and ammunition."[2]

Carter's reference to "the very circumstances which McNamara felt would be 'quite exceptional'" introduces another aspect of CESA as applied to naval nuclear propulsion that probably bears investigation: the political evaluations and judgments that perhaps have been built into CESA. In retrospect, it seems evident that Secretary McNamara

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[1]Carter, "Nuclear Carriers," p. 1371.

[2]Ibid., p. 1371.

downgraded the "operational benefits to be derived from the nuclear powered carrier, particularly in limited war situations," at least in part because the major U. S. defense problem was to be "completely protected against Soviet military and political pressure" and because "the substitution of a nuclear-powered carrier for the conventional would not strength us vis-a-vis the Soviets."[1] And so far as escort vessels are concerned, it seems equally evident that similar evaluations and judgments have been built and perhaps are still being built into CESA studies of fleet requirements.

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[1]U. S. Congress, House, Committee on Armed Services, Hearings on Military Posture, 87th Congress, 2nd Session, p. 3259; Hearings, Nuclear Propulsion for Naval Surface Vessels, pp. 163--164.

CHAPTER V

CONCLUSIONS

Basic Considerations

Although it is not now known what kinds and types of data and analyses may be employed by future policymakers and administrators of the Department of Defense to evaluate nuclear propulsion, recent evidence and experiences, particularly with respect to the question of the type of propulsion to be given carriers and escorts, indicate at least three points that are basic to a consideration of future policies, programs and decisions pertaining to naval nuclear propulsion:

(1) Are CESA or similar evaluative tools, and the conclusions based on them, relevant to problems such as naval nuclear propulsion? If they are relevant, are they fused and compatible with the experiences, insights, and even intuitions of military leaders and others having direct and immediate experience with the operation of naval forces? Admiral Rickover has said that "the principal difference between my views and those of the systems analysts is that they do not appear constrained to base their theories on existing evidence."[1]

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[1] Hearings, Department of Defense Appropriations for 1969, Part 6, p. 124.

Luther J. Carter has suggested a possible remedy for the situation Admiral Rickover has alleged to exist: "The next real breakthrough in the use of nuclear ships may come from collaboration between naval forces afloat and systems analysts ashort--all working to develop new concepts which can exploit to the full the advantages peculiar to nuclear propulsion."[1]

(2) What political evaluations and judgments are built or not built into recommendations and decision involving naval nuclear propulsion? Because of the classified nature of much national defense information, this is a very difficult question to raise and to try to answer satisfactorily. Yet there seems little doubt that vital determinants of policy toward naval nuclear propulsion rest, at least ultimately, that the decision to give the John F. Kennedy conventional propulsion rested partly on the assumption that the likelihood of the United States becoming involved in limited war situations such as Vietnam was rather low.

(3) Is the national defense establishment properly organized, managed, and operated, or does it require reorganization and new operational codes, to insure that policy governing naval nuclear propulsion emerges from a fit and proper amalgam of political, economic and strategic prudence and wisdom? The "collaboration between naval forces afloat and systems analysts ashore" to which Carter has referred

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[1]Carter, "Nuclear Carriers," p. 1371.

would not of itself insure that policy toward naval nuclear propulsion would be fused with or based upon wise and prudent political evaluations and judgments, unless it is assumed that naval officers or systems analysts or both can and should make such judgments, or that work on the staff level within the defense establishment has proceeded and still proceeds on the basis of political instructions and guidance that have been formulated by those authorities in Government best able to do so. Since these are questionable assumptions, it is fit and proper that this matter receive close and careful review.

Possible Future Steps

Altogether, the three basic points just outlined imply that the problem of naval nuclear propulsion cannot be dealt with adequately unless the total fabric of national defense policymaking and administration is laid out and examined in detail. Yet lesser steps could be taken that not only could help to clear up or define more precisely the problem of naval nuclear propulsion, but throw additional light on whether this problem can be attacked without spreading out the whole of the national defense fabric. The steps include:

(1) Giving careful attention to the argument that United States naval ships should always incorporate the most advanced technological developments, and that nuclear propulsion is unique and incomparably superior to conventional propulsion. Future use of what might be called "the McNamara approach" to defense policy depends significantly on how this argument is appraised.

(2) Endeavoring to obtain as fully as possible--and perhaps more so than in the past--the views of military experts and Defense Department studies pertaining to naval nuclear propulsion.

The Navy is and has been committed intellectually to the goal of a nuclear navy. It was reported in a 1957 issue of Nucleonics, for for example, that Admiral Arleigh A. Burke, the then Chief of Naval Operations, had a "huge flat book" in his office that contained the blueprint for the "complete conversion of the United States combat fleet to nuclear propulsion".[1] However, at about the same time, Admiral Burke was advising the Congress that "The cost of nuclear power will determine the rate of providing this type of power in new ships."[2]

More recently, there has been a great deal of "verbal committment" to an endorsement of something approaching a nuclear Navy--a Navy utilizing nuclear power for submarines, for aircraft carriers and for some escorts to at least accompany the nuclear carriers.

In February, 1970, issue of Navy, The Magazine of Sea Power, the following quotations are supportive:

> Secretary Laird: As we move into the decade of the 70's, it is essential that we continue to apply the best technological resources of our nation to assuring the sea power modernization which was heralded when the Navy

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[1] John E. Kenton, "Nuclear Navy Paces United States Atomic Industry--75--100 Reactos Over Next 8 Years Leads Industry in History's Biggest Reconversion Program," Nucleonics, July, 1957, reprinted in Congressional Record, July 22, 1957, p. 12384.

[2] Ibid.

launched the era of nuclear ship propulsion.

Secretary of the Navy John H. Chaffee: Nuclear propulsive power, for the first time since the days of sail, provides our Navy's ships with ranges limited only by the endurance of their crews, thus adding an unprecedented and invaluable mobility, flexibility and staying power to the naval forces of the free world. In the challenging years ahead, the security of our country will depend in large measure on continued progress in nuclear propulsion.

Admiral Thomas H. Moorer: The far-sighted men who pioneered the development of nuclear power and the dedicated men who take it to sea merit the tribute of their grateful countrymen. As we face a future filled with challenge, nuclear power will ensure continued endurance at sea which we must possess in order to protect the security of our nation.[1]

As to Defense Department studies pertaining to naval nuclear propulsion, it appears to this writer that Admiral Rickover's comments in March, 1967 to the Joint Committee on Atomic Energy are still relevant in 1972. Rickover stated that "the question of utilizing nuclear propulsion in surface warships has been studied many times over the years and another study is underway."[2] In answer to the question, "Is it really necessary to complete more studies before we can decide to provide nuclear powered escorts for our nuclear powered aircraft carriers?" the Admiral said: "No sir, I do not. I agree that the amount and proportion of air, submarine, and surface

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[1] Navy: The Magazine of Sea Power, February, 1970, p. 11

[2] Hearings, Naval Nuclear Propulsion Program--1967-68, p. 49.

protection required for a nuclear carrier and the amount of protection needed for other forces needs further study. . .. I am concerned over the degree to which the Navy is getting committed to the concept that no decision can be made concerning major fleet escorts until the Major Fleet Escort Study and the DX/DXG concept formulation studies have been completed."[1]

The Congress has made it explicitly clear that it believes that nuclear carriers should have nuclear escorts and is willing to move ahead in its efforts to modernize the Navy with nuclear propulsion. The Department of Defense studies have been primarily interested in determining the relative costs of nuclear warships as compared to their conventional counterparts, rather than seeking new ways to exploit the advantages of nuclear propulsion.[2]

Finally, one of the largest factors looming the future of nuclear propulsion must center around the future of Vice Admiral Hyman G. Rickover. Although his tenacity and remarkable stamina do not appear to have lessened in the twenty-five years during which he has ruled the Naval Nuclear Propulsion Program, it only seems obvious for one to wonder how much longer this 72-year old gentleman will be able or have the desire to continue his single-handed, perpetual battles with the Department of Defense.

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[1] Ibid., pp. 58-60.

[2] Ibid.

Whether one agrees with Admiral Rickover or not, no one can dispute his brilliant success in bringing nuclear propulsion as far as he has in the United States Navy. Fortunately, for those who favor increasing the role of nuclear propulsion in the Navy, Admiral Rickover has made many valuable liaisons with influential members in both Houses of the Congress. Whether this influence will be transferred to his ultimate successor remains to be seen.

Hopefully, when the Admiral does make the decision to "retire from his retirement status", the future of nuclear propulsion will be well-advanced toward the establishment of a nuclear-powered fleet. It would certainly seem to this writer that in view of the obvious tactical and strategic superiority of nuclear surface ships, and their reduced dependence on logistical support, the future of nuclear power in our fighting ships of tomorrow should be guided by Admiral Farragut's words at the Battle of Mobile Bay in 1864 -- "Damn the torpedoes, full speed ahead!"

APPENDIX A

The Secretary of Defense
Washington, D.C., March 25, 1968

MEMORANDUM FOR THE PRESIDENT

The fiscal year 1967 authorization bill, as reported by the House, contained a mandatory requirement that:

"The Secretary of Defense and the Secretary of the Navy shall proceed with the design, engineering, and construction of the two nuclear-powered guided-missile frigates as soon as possible."

The Department of Defense objected to this mandatory language and the conferees reported the bill, which was enacted, with a requirement that:

"The contract for the construction of the nuclear-powered guided-missile frigate for which funds were authorized under Public Law 89-37, and for which funds are authorized to be appropriated during fiscal year 1967, shall be entered into as soon as practicable unless the President fully advises the Congress that its construction is not in the national interest."

Construction of this fiscal year 1967 nuclear-powered guided-missile frigate (DLGN-36) was approved and contracting actions are being undertaken.

By section 101 to Title I of Public Law 90-22, approved June 5, 1967, 81 Stat. 52, funds were authorized to be appropriated during the fiscal year 1968 for the construction of two additional nuclear-powered guided-missile frigates (DLGN-37 and DLGN-38). That statute further provided that:

". . .The contracts for the construction of the two nuclear-powered guided-missile frigates shall be entered into as soon as practicable unless the President fully advises the Congress that their construction is not in the national interest. . . ."

Even having reprogrammed $26 million for the DLGN-36, we need an additional $23 million to fully fund the ship. If we also proceed with DLGN-37, we will need a total of $68 million more than now appropriated. Should we also proceed with DLGN-38, the total additional funding would amount to $228 million.

As you recall, the program which the Secretary of Defense recommended last December would provide six new nuclear escorts, the last being funded in fiscal year 1971. The six ships, in combination with the three nuclear escorts we already have, would give us two all-nuclear attack carrier groups. We also recommended that options for further nuclear escort construction be obtained in the event that we should later decide to move to a total of four all-nuclear groups. Of the six new nuclear escorts, one would be DLGN-36, and the remaining five

would be a new class tentatively called the DXGN. (The DXGN is smaller than the DLGN, has one missile system rather than two, and would cost $40--50 million less, depending on how many we built.) Under this plan, we would build neither DLGN-37 or DLGN-38.

The Navy recommends an alternative under which we would build DLGN-36 and DLGN-37 (but not DLGN-38), and four DXGN's also maintaining the option for further construction in the future. On balance, I believe that the Navy's proposal has merit. In the long run, building one more DLGN and one less DXGN would cost us roughly $50 million more. On the other hand, it would give us the ship we need to round out our first all-nuclear attack carrier task group roughly 18 months sooner, since DLGN-38 is essentially ready for construction, while the DXGN design is not. Though some reprogramming would be required, the table above shows that $322 million are available toward the $380 million required for DLGN-36 and DLGN-37. The $52 million already proposed in the fiscal year 1969 budget for DXGN funding would more than cover the difference. Indeed, with an additional $22 million of reprogramming of fiscal year 1969 funds, we could provide $26 million for long lead-time components for the first DXGN, which would be fully funded in fiscal year 1970.

The language of Public Law 90-22 makes it clear that the Congress intended that, in addition to DLGN-36, two more nuclear frigates be built. At the time that law was written, however, the estimated costs of building all three ships was, as shown above, $139 million less than it is now. DLGN-38, the second of the two ships specified by the Congress in Public Law 90-22, is now estimated to cost $180 million, rather than the $135 million originally estimated. I believe that, rather than building that ship, we should build a fourth DXGN at a cost of about $129 million.

The reasons that we expect the DXGN to be that much less expensive than the DLGN are that it will be specifically designed for economical series production of identical ships; and that it will incorporate a modular design concept so that it can later be modernized with new weapons systems quickly and easily. In addition, by using modern techniques of automation and design for ease of maintenance, we believe we can significantly reduce the cost and number of men it will take to operate these ships.

In addition, it is important to realize that the Navy studies which justified these nuclear escorts did so on the basis that their primary mission would be the escort of nuclear carriers. For that mission, the DXGN's single missile system is adequate, as shown by the Navy study. Had the higher cost DLGN's been assumed in that study, nuclear escorts would not have been competitive with conventional escorts. While it is true that some nuclear escorts would be needed and used from time to time for missions other than escorting nuclear carriers where more than one missile system might be desirable, the Navy's recommended program will provide four such ships (DLGN-36, DLGN-37, and the existing DLGN-25, all with two missile systems, and the CGN-9 with three missile systems· the existing DLGN-35 has a single missile system). Therefore, I believe

that we do not need DLGN-38, and that we should complete two all-nuclear attack carrier task groups by building DLGN-36 and DLGN-37, followed by four DXGN's, the first two in fiscal year 1970, and the last two in fiscal year 1971.

In summary, I conclude that proceeding with the construction of the first of the two frigates (DLGN-37) authorized in Public Law 90-22 would be in the national interest, but that construction of the second (DLGN-38) would not. If you agree with that conclusion, I recommend that you sign the attached Memorandum of Determination. Compliance with the statute will be accomplished by notification to the President of the Senate and the Speaker of the House by me on your behalf.

/s/ Clark Clifford

Reprinted from Hearings, Department of Defense Appropriations for 1969, Part 6, pp. 311--313.

APPENDIX B

The Deputy Secretary of Defense
Washington, D.C., May 5, 1971

Hon. John O. Pastore
Chairman, Joint Committee on Atomic Energy
U. S. Senate

Dear Mr. Chairman:

In view of your deep interest in Defense budget and program matters, I thought it would be useful to inform you of a recent decision that I made on the nuclear powered frigate (DLGN-38) program.

We are about to negotiate a multi-ship contract for the construction of DLGN-38 class frigates. Before negotiations can proceed a decision is needed on how many ships the contract should cover. The Navy proposed two alternative programs for the construction of nuclear frigates for the FY 70-74 time frame. One alternative included three ships, the DLGN-38 class vessels funded in FY 70 and FY 71 and requested in the FY 72 Budget. The second alternative was a five-ship program which included two additional DLGN-38 ships to be started in FY 73 and FY 74.

After reviewing the two options carefully and discussing them at length with the Secretary of the Navy and the Chief of Naval Operations, I have approved the recommendation of the Secretary of the Navy that we proceed with the three-ship program. My reasons were similar to many of the considerations in my decision to postpone construction of an additional nuclear powered carrier. The very substantial overall cost of these ships, limitations on funds available for Defense, and other high priority needs, led me to conclude that we should only plan to build three nuclear firgates at this time.

This decision was also influenced by the significant increase in the cost of the DLGN-38 over earlier estimates. These cost considerations coupled with the expected strong pressures on Defense spending over the next few years, made me especially concerned over being committed to a multi-year contract for ships beyond those already funded or proposed to the Congress.

Sincerely,

/s/ David Packard

Reprinted from Hearings, Naval Nuclear Propulsion Program -- 1971, pp. 75-76.

APPENDIX C

The Secretary of Defense
Washington, D.C., April 5, 1971

Hon. Henry M. Jackson
U. S. Senate

Dear Henry:

Reference is made to your letter of March 25, 1971, in which you expressed your deep interest in the Navy's nuclear powered surface ship program.

With respect to the CVAN 70, we are actively reviewing both the industrial base and cost implications involved. Upon completion of this review, we would expect to be in a position to make a firm decision on the FY 1972 budget.

Insofar as the DLGN 38 Class of nuclear frigates is concerned, we have recently conducted a Defensy Systems Acquisition Review Council (DSARC) review of the Navy's contractual plans and production schedule. These, in turn, were based upon negotiations with the Newport News Shipbuilding and Drydock Company with a prospective contract award date of April 30, 1971. As you are aware, the DSARC is an integral part of the processes which have been established by Deputy Secretary Packard and me with the objective of improving the acquisition of weapons systems for the Department of Defense. We expect a decision on this program in the very near future.

I appreciate your interest in these matters.

Sincerely,

/s/ Melvin R. Laird

Reprinted from Hearings, Naval Nuclear Propulsion Program -- 1971, p. 69.

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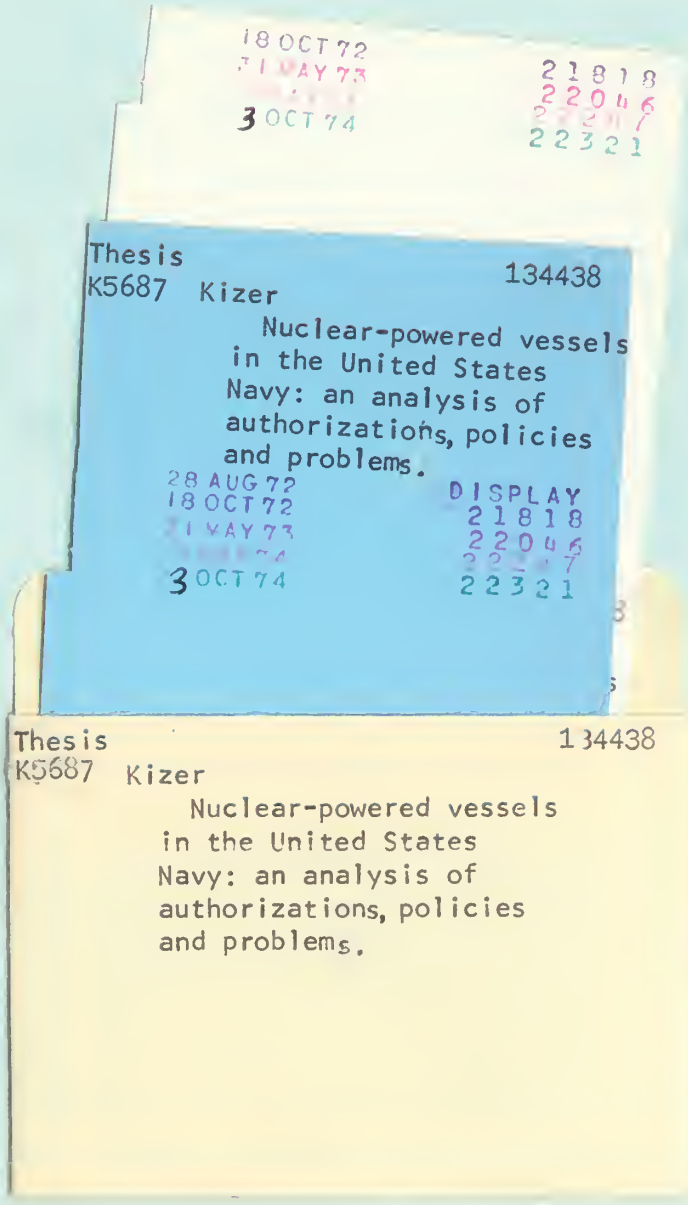

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